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(54) **SHELVING FOR SAFE TRANSPORTATION OF CONCENTRATION SOLAR PANELS**

(57) This invention comprises a frame (1) of bars formed by an upper side, a lower side, and lateral sides and comprises brackets that exert a limit to the movement of the panels (7), which are conveniently drilled to the surface opposite to the front of the load. Interior shelves (2) and exterior shelves (3) inside the frame (1), formed by flat structures, are attached to the brackets (6) with spaces (4) in which the panels are housed (7). The exterior shelves (2) are joined by angles (8) facing the load, while some strips (9) join the interior shelves (3) to at least one adjacent shelf (2, 3). Elastic cushions are inserted between the shelves (2, 3) and the strips (9), or the angles (8) to absorb any displacements. Closing means in the form of closed profiles are incorporated to prevent the panels from sliding out of the frame (1). The panels (7) can be arranged horizontally or vertically.

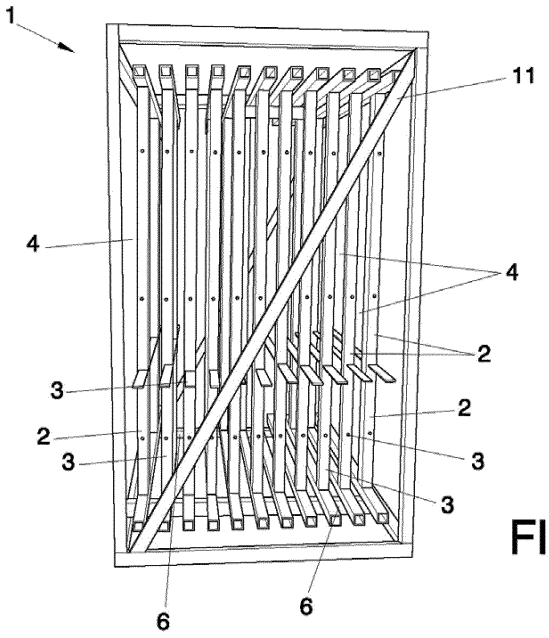

FIG. 2

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Description

OBJECT OF THE INVENTION

[0001] The present invention falls within the field of solar energy.

[0002] The object of the patent consists of a rack for transporting solar mirror facets which is adapted for protecting said mirror facets from impacts and vibrations during transportation thereof.

BACKGROUND OF THE INVENTION

[0003] The mirror facets used in installations of solar concentration mirrors have a side equipped with a mirror. Due to the fragility of the mirror, every precaution must be taken when transporting said mirror facets in order to avoid damage to said mirror.

[0004] To date, solid wood cases closed by side panels and custom-made according to the size of the mirror facets have been used in an attempt to protect said facets from impacts and vibrations during transport thereof. However, this solution has the drawback that the rigidity of the wooden case does not provide sufficient protection against impacts and vibrations. Additionally, the mirror facets, transported in the previously described manner, come into contact with the panels, wherefore the risk of breakage is not eliminated. As a result of said drawbacks, approximately 30% of the transported facets are broken during transport thereof.

DESCRIPTION OF THE INVENTION

[0005] The present invention overcomes the aforementioned drawbacks by providing a rack for the secure transportation of solar concentration facets which prevents the mirror from coming into contact with any bodies that could damage said mirror, in addition to keeping the facets fixed to the rack, with the absence of spaces that could cause the facets to strike against the rack due to vibrations and jolts.

[0006] The rack of the invention has a frame formed by a parallelepiped structure composed of bars, wherein said bars define an inner face, an upper face and four lateral faces.

[0007] Facets are rectangular structures wherein a larger side and smaller side can be observed. Once the facets are inside the rack of the invention, said facets will be disposed parallel to two of the frame faces, called main sides, the inner dimensions of which are substantially identical (except for small spaces) to the dimensions of the larger sides and smaller sides of the facets.

[0008] The facets are introduced in the interior of the frame through a face called load face and in a direction called load direction, which corresponds to the direction which is perpendicular to the load face.

[0009] The invention envisages that the facets can be disposed in the interior of the frame arranged horizontally (substantially parallel to the ground) or, alternatively, arranged vertically (substantially perpendicular to the ground). To this end, two preferred embodiments will be presented, wherein the frame of each is adapted to one of the aforementioned arrangements.

[0010] The load face can be any of the sides other than the main sides; however, in the case of vertical arrangement, the load face is preferably the upper side, while in the case of horizontal arrangement of the facets, the load face is preferably the lateral face, the dimensions of which are substantially identical to that of the smaller sides of the facets.

[0011] At least one support (preferably two supports) that serve as a butt to stop the facets as they move along the load direction, are disposed on the face opposite the load face in the interior of the frame. Preferably, said supports comprise at least one bar or one open profile (preferably two bars or two open profiles).

[0012] The frame comprises shelves within that divide the interior of the frame into cavities adapted to house the facets. The shelves are preferably formed by flat bar structures fixed to the supports, preferably screwed to the supports, which define cavities wherein the facets are housed. The shelves can be outer shelves (those which are nearest the main faces) and inner shelves (the rest).

[0013] The amplitude of the cavities defined by the shelves is such as to allow easy insertion and removal of the facets, but not such as to allow spaces susceptible of causing damage to the facets during transportation thereof.

[0014] The outer shelves are joined to the load face by first joining means. Preferably, the first joining means are angle brackets screwed to the outer shelves and to at least one of the bars of the load face. Likewise, the inner shelves are joined to at least one adjacent shelf by means of second joining means, which are preferably anchoring strips screwed to an inner shelf and to at least one adjacent shelf.

[0015] Movement of the facets in the interior of the frame is restricted along the load direction by the supports and angle brackets/strips, as well as along a direction perpendicular to the load face by means of the shelves.

[0016] According to a preferred embodiment of the invention, pads made of elastic or plastic material are disposed between the outer strips or angle brackets and the shelves for the purpose of absorbing minor deformations.

[0017] The faces other than the main faces may have sealing means to prevent the facets disposed in the interior of the rack to accidentally abandon said rack. The sealing means may be both fixed and removable, although they are preferably fixed and comprise corresponding bars or profiles disposed on two opposite faces. The faces where the sealing means are located are called sealing faces and correspond to different faces, depending on whether the facets are arranged horizontally or vertically.

[0018] In the rack of the invention, the mirror facets are

not in contact with any bodies. Additionally, the shelves are joined together, minimising the risk of impacts and vibrations. Finally, the sealing means provide an additional safety element, securing the position of the facets in the interior of the frame in case of failure. It is observed that the invention provides complementary restrictions to the movement of the facets within the frame that reasonably guarantee the integrity of said facets in the event of vibrations, potholes, blows, etc. during transportation thereof.

DESCRIPTION OF THE DRAWINGS

[0019] In order to complete the description being made and with the object of helping to better understand the characteristics of the invention, in accordance with a preferred example of practical embodiment thereof, accompanying said description as an integral part thereof, is a set of drawings wherein the following has been represented in an illustrative and non-limiting manner:

Figure 1. Shows a perspective view of the empty rack in the case of vertical arrangement of the facets.
Figure 2. Shows a side view of the vertical arrangement of the facets in the interior of the frame.
Figure 3. Shows a detailed side view of the joint between the strips/angle brackets and the shelves.
Figure 4. Shows a perspective view of the empty rack in the case of horizontal arrangement of the facets.
Figure 5. Shows a side view of the vertical arrangement of the facets in the interior of the frame.

PREFERRED EMBODIMENT OF THE INVENTION

FIRST EMBODIMENT: VERTICAL ARRANGEMENT OF THE FACETS

[0020] In figure 1 it can be seen that the rack of the invention has a parallelepiped frame (1) composed of steel bars that define a lower face, an upper face and lateral faces. In the first preferred embodiment, the load face (the face where through the facets (7) are inserted in the rack) is the upper face. The facets (7) are rectangular structures wherein a larger side and a smaller side can be observed. The facets (7) are disposed in the interior of the rack according to the invention, parallel to two of the lateral faces of the frame, called main faces, the inner dimensions of which are substantially identical (except for small spaces) to the dimensions of the larger sides and smaller sides of the facets (7).

[0021] Likewise, in figure 1 it can be seen that the frame (1) includes two supports (6) in the form of U-shaped profiles fixed to the face opposite the load face. Said supports (6) act as a butt to stop the facets (7) as they move along the load direction, which is the direction perpendicular to the load face.

[0022] In figure 2 it can be seen that the frame (1) comprises shelves (2, 3) in its interior formed by flat bar structures which are screwed to the supports (6), defining cavities (4) wherein the facets (7) are housed. The shelves can be outer shelves (2) and inner shelves (3).

[0023] As can be observed in figure 2, the facets (7) are introduced in the frame (1) through the upper face, said facets (7) resting upon the supports (6).

[0024] Figure 3 shows screwed angle brackets (8) that join each of the outer shelves (2) to at least one of the bars of the load face. Screwable strips (9) are used to join the inner shelves (3) to at least one adjacent shelf (2, 3).

[0025] Pads (10) made of elastic or plastic material are disposed between the strips (9) or angle brackets (8) and the shelves (2, 3) for the purpose of absorbing small deformations.

[0026] The sealing faces, i.e. lateral faces other than the main faces, have sealing means (11) formed by bars or closed profiles disposed between vertices opposite said sealing faces, for the purpose of securing the position of the facets (7) in the case of an eventual failure in the joints between any of the facets (7) and the supports (6) or other facets (7), preventing the facets (7) from abandoning the frame (1) by means of said sealing faces.

SECOND EMBODIMENT: HORIZONTAL ARRANGEMENT OF THE FACETS

[0027] In figure 4 it can be observed that the rack according to the invention has a parallelepiped frame (1) composed of steel bars that define a lower face, an upper face and lateral faces. The facets (7) are rectangular structures wherein a larger side and smaller side can be observed. The facets (7) are disposed in the interior of the rack of the invention parallel to two of the lateral faces of the frame, called main faces, the inner dimensions of which are substantially identical (except for small spaces) to the dimensions of the larger sides and smaller sides of the facets. In the second preferred embodiment, the load face is one of the lateral faces other than the main faces.

[0028] Likewise, it can be observed in figure 4 that the frame (1) incorporates two supports (6) in the form of a U-shaped profile to the face opposite the load face. Said supports (6) act as a butt to stop the facets (7) as they move along the load direction, which is the direction perpendicular to the load face.

[0029] In figure 5 it can be seen that the frame (1) comprises shelves (2, 3) in its interior, formed by flat bar structures, which are screwed to the supports (6), defining cavities (4) wherein the facets (7) are housed. As can be observed in figure 5, the shelves can be outer shelves (2) and inner shelves (3).

[0030] As can be observed in figure 5, the facets (7) are introduced into the frame (1) through one of the lateral faces other than the main faces, said facets (7) resting upon the supports (6).

[0031] Figure 3 shows screwed angle brackets (8) that

join each of the outer shelves (2) to at least one of the bars of the load face. Screwable strips (9) are used to join the inner shelves (3) to at least one adjacent shelf (2, 3).

[0032] Pads (10) made of elastic or plastic material are disposed between the strips (9) or angle brackets (8) and the shelves (2, 3) for the purpose of absorbing small deformations.

[0033] The sealing faces, i.e. lateral faces other than the load faces, have sealing means (11) formed by bars or closed profiles disposed vertically in the interior of the sealing face. The sealing means (11) secure the position of the facets (7) in the case of an eventual failure in the joints between any of the facets (7) and the supports (6) or other facets (7), preventing the facets (7) from abandoning the frame (1) by means of said sealing faces.

[0034] The rack additionally comprises legs (14).

Claims

1. Rack for secure transportation of solar concentration mirror facets (7), **characterised in that** it comprises:

   - a parallelepiped frame (1) composed of bars that define a lower face, an upper face and lateral faces, the frame (1) being adapted to allow insertion of the facets (7) in said frame (1) through a load face along a load direction perpendicular to said load face;
   - supports (6) fixed to the face opposite the load face, which act as a butt to stop the facets in their movement through the interior of the frame (1) along the load direction;
   - inner shelves (2) and outer shelves (3) disposed in the interior of the frame (1), joined to the supports (6), defining cavities (4) wherein the facets (7) are housed;
   - first joining means between the outer shelves (3) and any of the bars of the load face; and
   - second joining means between an inner shelf (2) and at least another adjacent shelf (2, 3).

2. Rack for secure transportation of solar concentration mirror facets (7), according to claim 1, **characterised in that** the frame is adapted for transporting facets disposed horizontally.

3. Rack for secure transportation of solar concentration mirror facets (7), according to claim 2, **characterised in that** the load face is a lateral face.

4. Rack for secure transportation of solar concentration mirror facets (7), according to claim 1, **characterised in that** the frame is adapted for transporting facets disposed vertically.

5. Rack for secure transportation of solar concentration mirror facets (7), according to claim 4, **characterised in that** the load face is the upper face.

6. Rack for secure transportation of solar concentration mirror facets (7), according to any one of the preceding claims, **characterised in that** the first joining means are angle brackets (8) adapted for being screwed to the outer shelves (3) and to any of the bars of the load face.

7. Rack for secure transportation of solar concentration mirror facets (7), according to any one of the preceding claims, **characterised in that** the second joining means are strips adapted for being screwed to an inner shelf (2) and to at least another adjacent shelf (2, 3).

8. Rack for secure transportation of solar concentration mirror facets (7), according to any one of the preceding claims, **characterised in that** it additionally comprises sealing means (11) on two of the opposing lateral faces that prevent the mirror facets (7) from falling out through said faces.

9. Rack for secure transportation of solar concentration mirror facets (7), according to claim 8, **characterised in that** the sealing means (11) are closed profiles disposed between opposing vertices of the lateral faces where they are disposed.

10. Rack for secure transportation of solar concentration mirror facets (7), according to claim 8, **characterised in that** the sealing means (11) are closed profiles disposed between two opposing bars of the face where they are disposed.

11. Rack for secure transportation of solar concentration mirror facets (7), according to any one of the preceding claims, **characterised in that** it incorporates pads (10) made of elastic or plastic material disposed between the strips (9) or angle brackets (8) and the shelves (2, 3) for the purpose of absorbing small deformations.

12. Rack for secure transportation of solar concentration mirror facets (7), according to any one of the preceding claims, **characterised in that** it comprises two supports (6).

13. Rack for secure transportation of solar concentration mirror facets (7), according to any one of the preceding claims, **characterised in that** it incorporates legs (14).

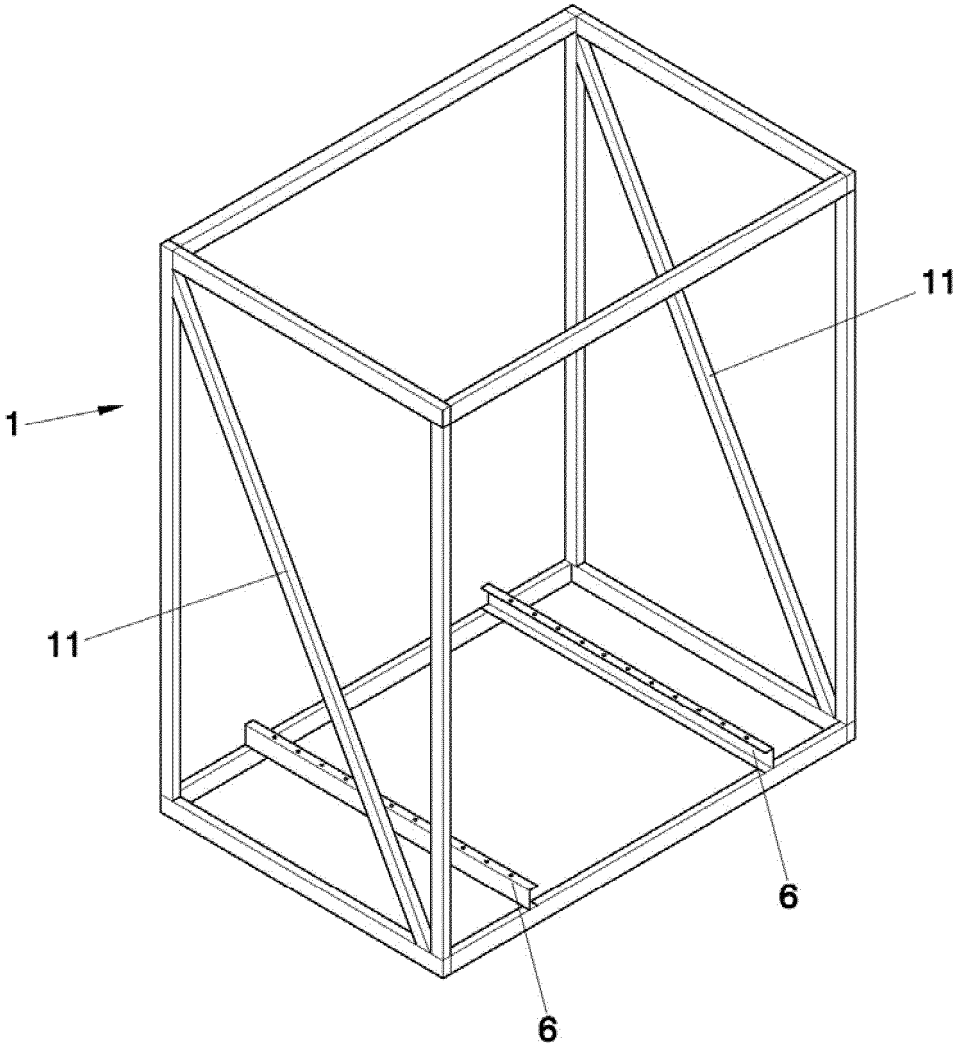

FIG. 1

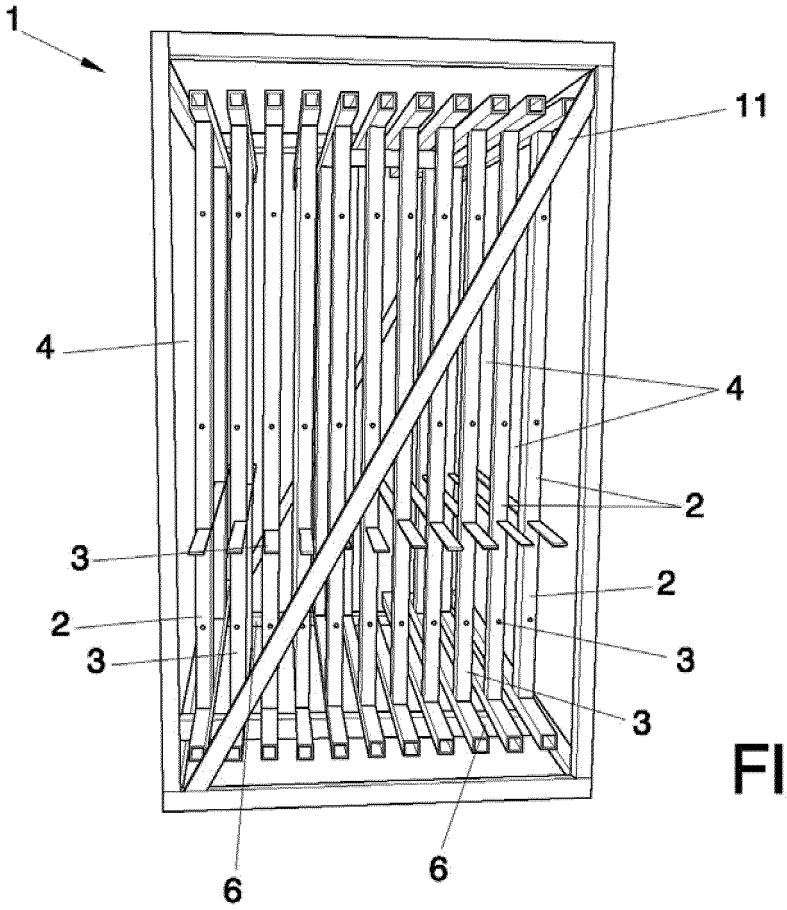

FIG. 2

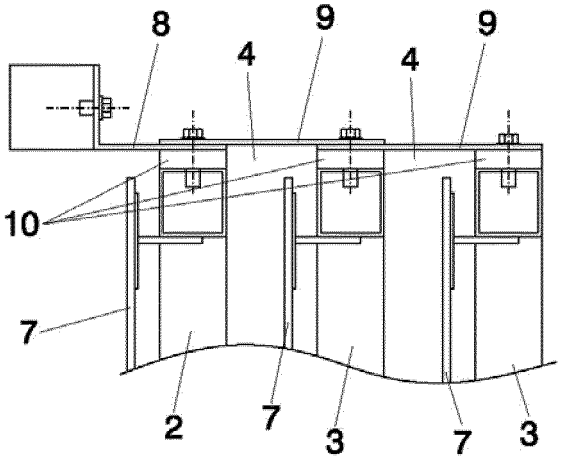

FIG. 3

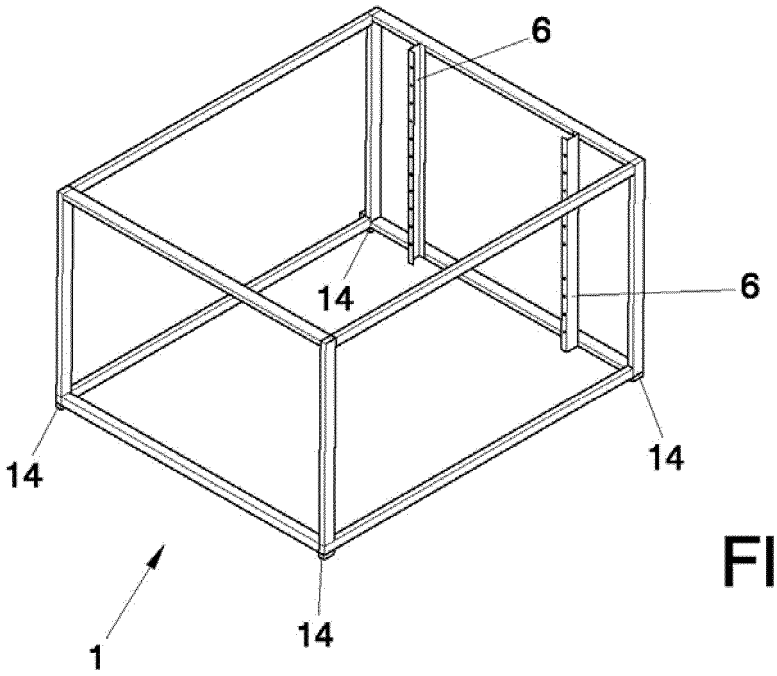

FIG. 4

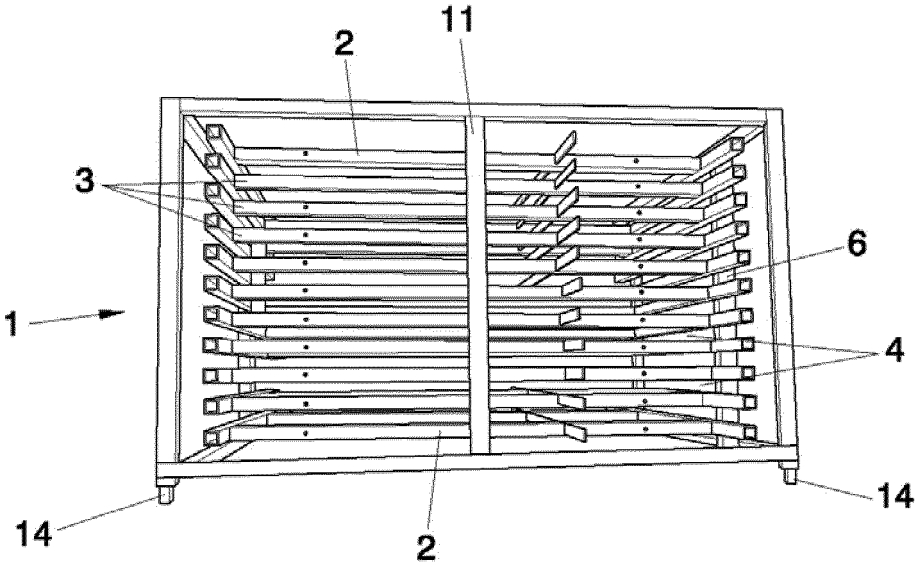

FIG. 5